

**UNION PACIFIC & BURLINGTON NORTHERN SANTA FE RAILROADS' SPECIFICATIONS**  
**for**  
**MAIN, BRANCH and YARD TRACK BALLAST**

**August 1, 2001**

**02854 CRUSHED ROCK BALLAST**

**02854.1 DESCRIPTION**

- A. These specifications cover the types, characteristics, property requirements and manufacture of mineral aggregates for processed (prepared) ballast. Processed ballast shall be hard, dense, of angular particle structure, providing sharp corners and cubicle fragments and free of deleterious materials. Ballast material shall provide high resistance to temperature changes, chemical attack, have high electrical resistance, low absorption properties and free of cementing characteristics. Materials shall have sufficient unit weight (measured in pounds per cubic foot) and have a limited amount of flat and elongated particles.
- B. The type or types and gradation(s) of processed ballast materials as covered in these specifications and testing requirements shall govern the acceptance or rejection of ballast materials by the Railroads' Designated Engineers.
- C. A material safety data sheet shall be provided with all proposed materials.

**02854.2 MATERIALS**

**02854.3 PROPERTY REQUIREMENTS**

**02854.31 PHYSICAL ANALYSIS**

- A. Methods of sampling and testing as defined by this specification are those in effect August 1, 2001 and may be revised or altered by the Railroads' Designated Engineers. Refer to the attached tables for the appropriate ASTM testing method and applicable limits.
  - 1. Method of sampling - Field samples shall be secured in accordance with the current ASTM methods of sampling designation D-75. Test samples shall be reduced from field samples by means of ASTM C 702.
  - 2. Sieve Analysis - Sieve analysis shall be made in accordance with ASTM method of test, designation C 136.
  - 3. Material Finer Than No. 200 Sieve - Material finer than a No. 200 Sieve shall be determined in accordance with ASTM method of test, designation C 117.

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4. Bulk Specific Gravity and Absorption - The bulk specific gravity and percentage of absorption shall be determined in accordance with ASTM method of test, designation C 127.
5. Percentage of Clay Lumps and Friable Particles - Percentage of clay lumps and friable particles shall be determined in accordance with ASTM method of test, designation C 142.
6. Unit Weight - The weight per cubic foot shall be determined in accordance with ASTM method of test, designation C 29.
7. Percent of Flat and/or Elongated Particles - Percentage of flat and/or elongated particles shall be determined in accordance with U.S. Army Corps of Engineers Test CRD-C-119.
8. Plasticity Index - The plastic limit, liquid limit and plasticity index shall be determined in accordance with ASTM method of test designation D 423 and D 424. Each sample shall be tested in two ways; one test shall test the fines generated by the Los Angeles Machine and the other test shall test the fines contained in the total sample. The portions of these samples generated by the Los Angeles Machine and passing the #40 sieve shall be nonplastic (NP). The portion of the total sample passing the #40 sieve shall have a liquid limit of not more than 25 and plasticity index of not more than 6.
9. Mill Abrasion - A representative sample is obtained and sized using current ASTM methods of test. From the course aggregate, split a representative portion into a sample consisting of 3.3 pounds passing the 1/2 inch sieve and retained on the 1 inch sieve, plus 3.3 pounds passing the 1 inch sieve and retained on the 1/2 inch sieve. The sample shall be washed and oven-dried in accordance with the Los Angeles Abrasion Procedure. The sample will be placed in a 1-gallon, 9-inch external diameter porcelain ball mill pot, along with 6.6 pounds of distilled water. The mill pot shall be sealed and rotated at 33 R.P.M. for a total of 10,000 revolutions (5 hours). The sample shall then be washed-sieved through a number 200 sieve and oven-dried before weighing. Mill abrasion shall be calculated as a percentage of loss in weight by the following formula:  
  
Mill Abrasion = Loss in Weight x 100% Original Weight.
10. L.A. Abrasion - The L.A. Abrasion number shall be determined in accordance with ASTM Method of Test, designation C535.
11. Abrasion Number - The Abrasion number is a number calculated with the results of the Los Angeles Abrasion Test and Mill Abrasion Test. The Abrasion number shall be calculated by the following formula:

Abrasion Number = L.A. Abrasion + (5 x Mill Abrasion).

(Note: L.A. Abrasion is at 1,000 Cycles.)

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Union Pacific will perform its own Modified Mill Abrasion testing which includes 100 freeze/thaw cycles to determine suitability of ballast materials and compliance to specifications. Supplier will provide the above Mill Abrasion number as initial comparative test only.

#### **02854.32 LIMITING TEST VALUES**

- A. The following Tables Nos. 1 and 2 outline the limiting values of testing as may be defined by the designated test specifications. The values for unit weight and bulk specific gravity are minimum values while the remainder are maximum values.

#### **02854.33 GRADATIONS**

- A. The following Table No. 3 outlines the required gradations to which materials are to be processed for use as ballast. Grading of the processed ballast shall be determined with laboratory sieves conforming to ASTM Specification E 11.

#### **02854.4 PRODUCTION AND HANDLING**

- A. The aggregate production facility shall be of such design to permit production and/or blending without excessive working of the materials. The facility must be approved by the Railroads' Designated Engineers. The capacity of the production facility shall be adequate to efficiently produce anticipated daily loadings and provide sufficient stockpiles to facilitate loading without delays.
- B. The blending, stockpiling and other production handling operations shall be managed by the producer to minimize segregation of the finished product. Stockpiling operations shall minimize, as practical, breakage or excessive fall in stockpiling operations, and movement of wheeled or tracked machines over stockpile material shall be limited. Processed ballast shall be rewashed as necessary to remove fine particle contamination as defined by the specifications.

#### **02854.5 LOADING**

- A. The producer shall ensure the fitness of the cars for loading of prepared materials, arranging to clean cars of deleterious material, plug leaks, close doors and other like operations as necessary.

#### **02854.6 INSPECTION**

- A. The Railroad or its representative reserve the right to unscheduled visits to the producer's facility during usual business hours for the following purposes:
  - 1. Observe sampling and testing procedures to assure compliance with the requirements of these specifications.
  - 2. Obtain representative samples of prepared material being produced and shipped.

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3. Review plant inspection, methods, quality control procedures, equipment and examine test results for current and previous tests. Producer shall provide the inspector with such assistance, materials and laboratory testing equipment as necessary to perform on production site gradation and percent passing 200 mesh sieve analysis. Performance of these tests at the time of an unscheduled inspection visit is the right, but not the duty, of the inspector.

#### **02854.7 SAMPLING AND TESTING**

- A. The quality of the material to be used for ballast shall be determined by the supplier prior to its acceptance by the Railroads' Designated Engineers. A series of tests by the supplier, as specified herein, shall be made at a testing laboratory approved by the Railroads' Designated Engineers to establish the characteristics of the material being tested.
- B. Once a source has been accepted to supply ballast material, periodic quality control samples shall be taken by the supplier to ensure continued compliance with the specification. A representative sample of prepared ballast shall be taken for gradation from each 10,000 tons of ballast being loaded for shipment. This sample shall be taken in accordance with ASTM D 75 in the quantities as listed within that standard. The gradation report shall be prepared on each sample containing the following information: source identification, date, sample number, shipment or car number and the sieve analysis. The gradation specification shall appear on the test form.
- C. In event any two individual samples fail to meet gradation requirements, immediate corrective action shall be taken to restore the production process to acceptable quality. The Railroads' Designated Engineers shall be advised in writing of the corrective action begin taken. In the event of repeated failure, i.e., two or more samples failing in two successive shipments, purchaser reserves the right to refuse the shipment.
- D. A full range of laboratory testing as defined in the specification shall be performed at least two times a year or as directed by the Railroads' Designated Engineers to ensure the quality of the material being produced. The producer may not change the location of the source without prior approval of Railroads' Designated Engineers. If the producer encounters changes within the supply source, laboratory testing will be performed on the new material to ensure compliance with the specifications and test results supplied to Chief Engineer, Design for approval.
- E. Prior to installation, the producer should provide the Railroads' Designated Engineers with certified results of ballast quality and gradation as conducted by a testing laboratory acceptable to the Railroads' Designated Engineers. The producer shall receive approval from the Railroads' Designated Engineers for the testing laboratory prior to performing the above-mentioned tests.

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**02854.8 MEASUREMENT AND PAYMENT**

- A. Products shall be paid for by the ton. The Railroad will light weigh a minimum of three of each type of ballast cars and after cars have been loaded by the producer, will obtain loaded weights. The Railroad and producer shall then agree to the tons to be invoiced for each type of car loaded.
- B. The Railroad will, from time to time, randomly weigh loaded cars of ballast shipped by producer. In the event significant deviations from the mutually agreed quantity exist, an equitable adjustment in the payment for shipments made on the day the affected cars were shipped will be made and adjustments to the loading procedure made if necessary.

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**UNION PACIFIC & BURLINGTON NORTHERN SANTA FE  
RAILROAD COMPANYS**

Table No. 1  
Limiting Test Values  
For Main Track Ballast

**FULLY WASHED MAIN TRACK BALLAST MATERIAL**

PROPERTY	VALUE	ASTM TEST
Percent Material, Passing No. 200 Sieve	0.5%	X1.3 or C 117
Bulk Specific Gravity (See Note #2)	2.6%	C127
Absorption Percent	0.5%	C127
Clay Lumps & Friable Particles	0.5%	C142
Abrasion Number L. A. Abrasion	40.0% 25% max	C535 and MMA C-535
Soundness (Sodium Sulfate) 5 Cycles	2.0%	C88
Flat and/or Elongated Particles	5.0%	USACE CRD-C119 or D-4791
Plasticity Index L.A. Fines	NP	D423, D424
Total Sample Liquid Limit	25	D423, D424
Total Sample Plasticity Index	6	D423, D424

**NOTE #1:** The limit for Bulk Specific Gravity is a minimum value. Limits for the remainder of the tests are maximum values.

**NOTE #2:** With the implementation of these specifications on the below date, the railroads will only accept ballast which has been washed into the cars or stockpile. Deluge type washing of ballast after loading is not acceptable. The larger gradations will be sampled on the belt, material finer than a #200 sieve will be sampled from loaded cars.

**NP =** Nonplastic.

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UNION PACIFIC & BURLINGTON NORTHERN SANTA FE  
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Table No. 2  
Limiting Test Values  
Branch and Yard Ballast

**FULLY WASHED BRANCH AND YARD BALLAST MATERIAL**

PROPERTY	VALUE	ASTM TEST
Percent Material, Passing No. 200 Sieve	0.5%	X1.3 or C-117
Bulk Specific Gravity (See Note #2)	2.6%	C27
Absorption Percent	0.5%	C127
Clay Lumps & Friable Particles	0.5%	C142
Abrasion Number L.A. Abrasion Number	50.0% 35% max	C535 and MMA C-535
Soundness (Sodium Sulfate) 5 Cycles	5.0%	C88
Flat and/or Elongated Particles	5.0%	USACE CRD-C119 or D-4791
Plasticity Index L.A. Fines	NP	D423, D424
Total Sample Liquid Limit	25	D423, D424
Total Sample Plasticity Index	6	D423, D424

**NOTE #1:** The limit for Bulk Specific Gravity is a minimum value. Limits for the remainder of the tests are maximum values.

**NOTE #2:** With the implementation of these specifications on the below date, the railroads will only accept ballast which has been washed into the cars or stockpile. Deluge type washing of ballast after loading is not acceptable. The larger gradations will be sampled on the belt, material finer than a #200 sieve will be sampled from loaded cars.

**NP =** Nonplastic.

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UNION PACIFIC & BURLINGTON NORTHERN SANTA FE  
RAILROAD COMPANYS  
Table No. 3

**BALLAST GRADATIONS**

NOMINAL SIZE PERCENT PASSING (BY WEIGHT)												
SIZE NO.	SQ. OPENING	2 ½"	2"	1 ¾"	1 ½"	1 ¼"	1"	¾"	000	000	No. 4	No. 8
Class 1	2" - ¾"	100	90-100		50-80		10-35	0-10	0-5			
Class 2					100		95-100		25-60		1-10	0-5
Class 2	1" - 3/8"				100		90-100	40-75	15-35	0-15	0-5	
Class 3	¾" - 0"						100	90-100	20-55	0-10	0-5	0-1
<b>NOTE #1:</b> Gradation designation Class 1 is main track ballast material. Gradation designation Class 2 is secondary main, branch and yard ballast. Gradation designation Class 3 is for screening materials. With the implementation of these specifications on the date below, Class 1 and Class 2 ballast materials are required to be washed prior to loading.												